l'Observatoire de Paris — LESIA
Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique

Durham University

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PLDA

Green Flash

High performance computing for real-time science

Contribution from Observatoire de Paris on WP6
Final Design Review, April 6th 2018

European Commission

Project #671662 funded by European Commission under program H2020-EU.1.2.2 coordinated in H2020-FETHPC-2014

Contribution to WP 6: simulator

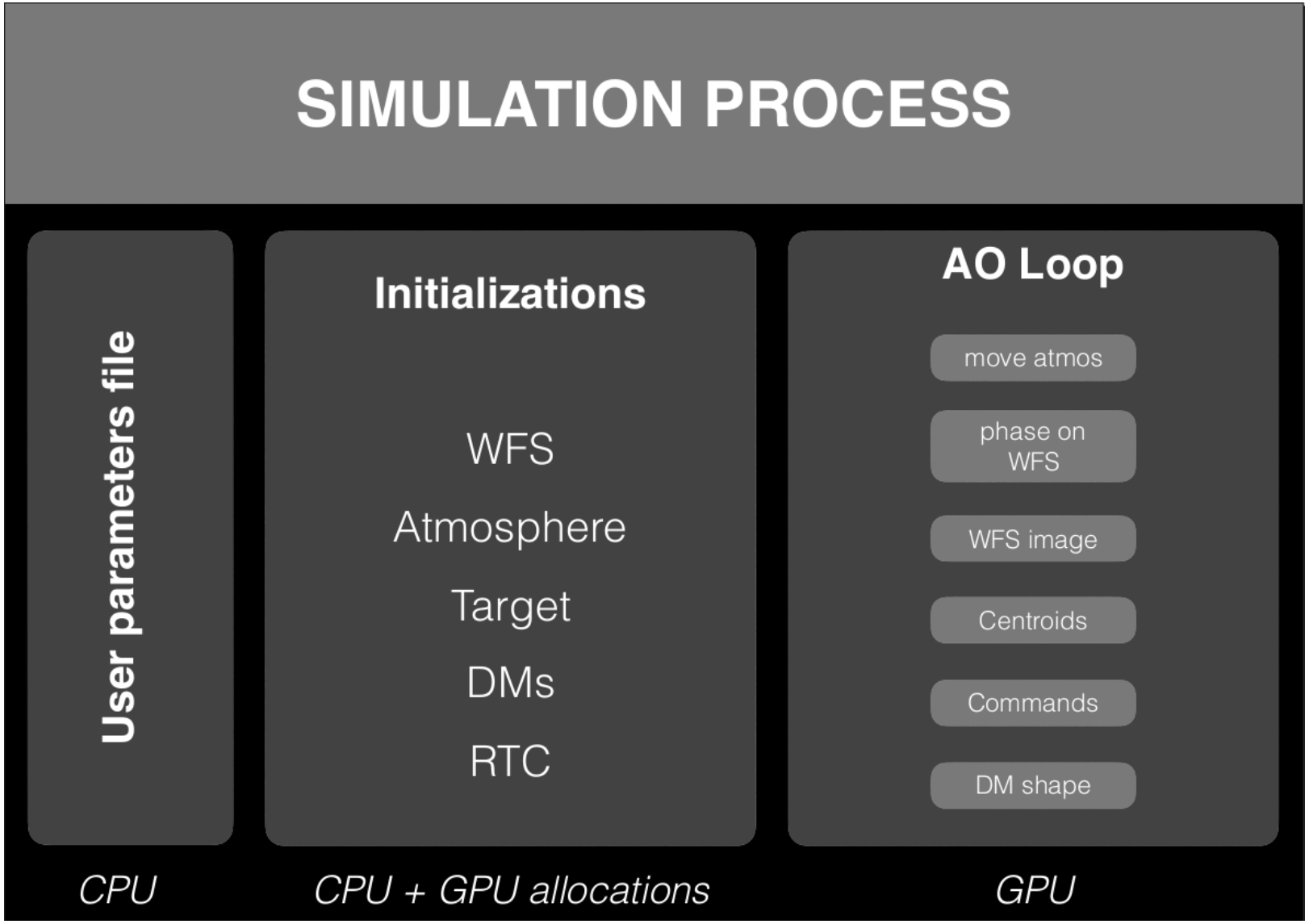
OdP team responsible for simulator SW development, integration and maintenance (task 6.2)

- efficient simulation platform based on GPU
- optimized interface with real-time core pipeline
- inherit from large scale project funded by French National Research Agency (ANR): COMPASS, ~1M€ budget, 6 partners in France, 36 months (ended in Feb. 2016)

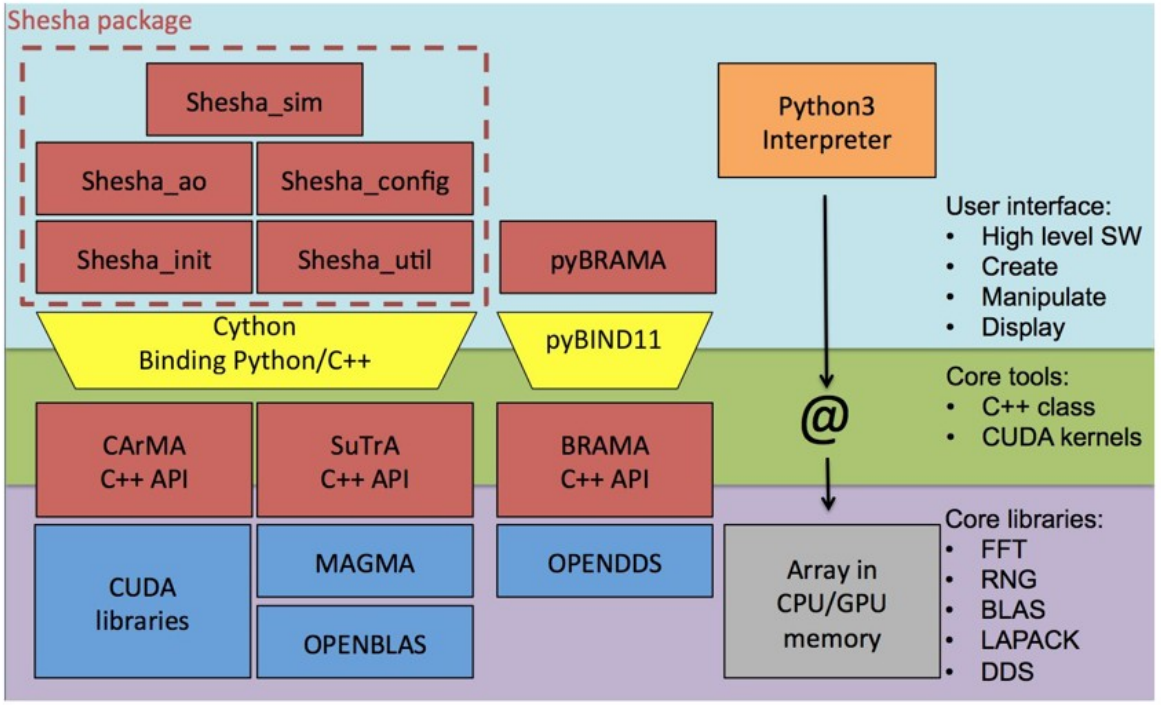
Coordination with UoD for deployment on selected HW and interfaces

- several levels of simulation with various accuracy
- critical component for final prototype performance assessment

The COMPASS platform



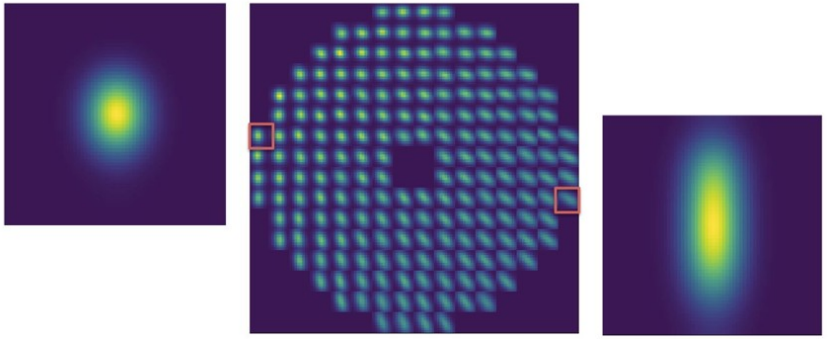
The COMPASS platform



Main computations relies on GPU:

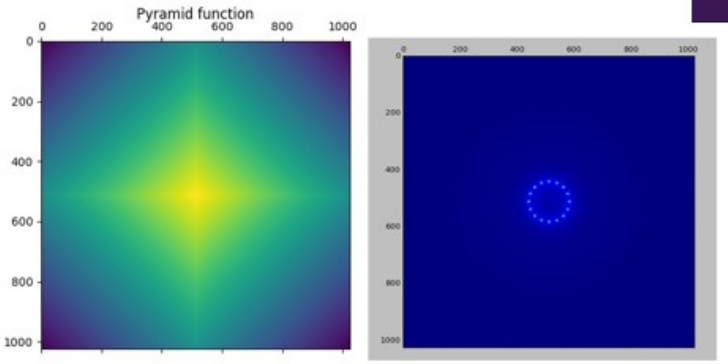
- **CArMA**: C++ Api for Massively parallel Applications
- **SuTrA**: Simulation Tool for Adaptive optics
- Use optimized libraries such as CUBLAS, CUFFT, MAGMA…

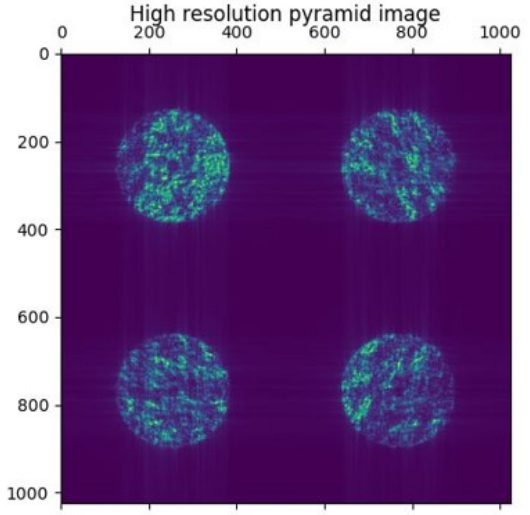
Features



Wavefront Sensor models:

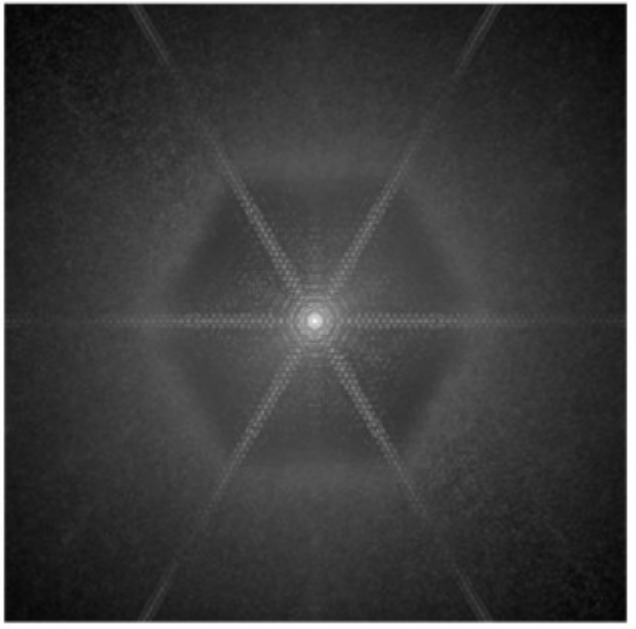
- Shack-Hartmann
- Pyramid
- Laser Guide Star

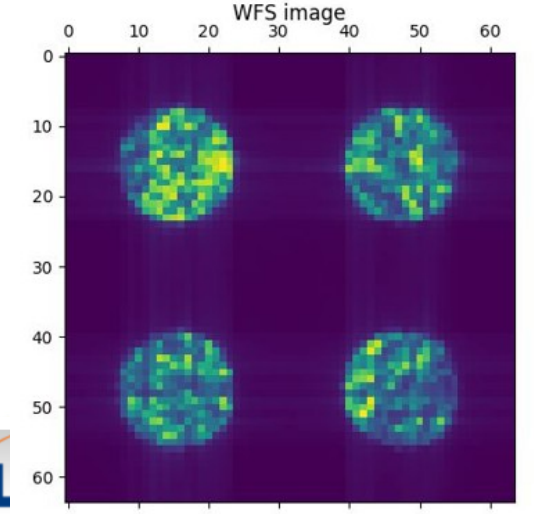




Centroiding methods:

- Center of gravity (cog)
- Thresholded cog
- Weighted cog
- Brightest pixels
- Correlation





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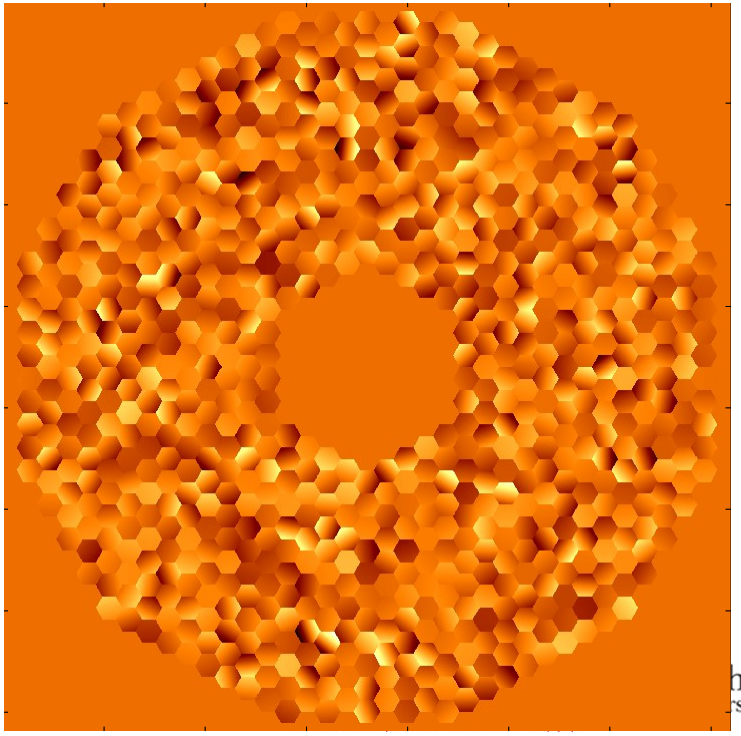
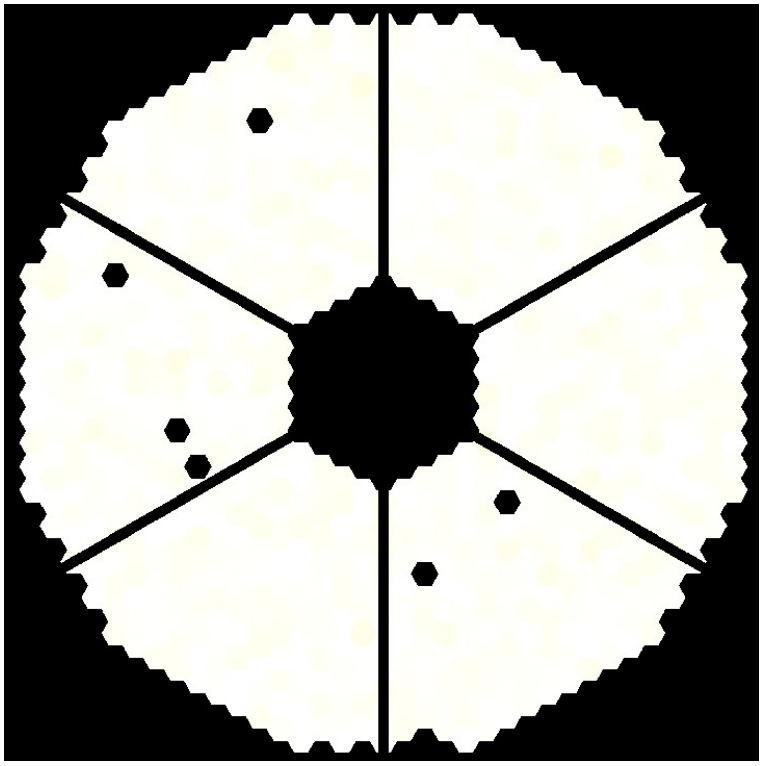
Features

Controllers:

- Least square
- Modal optimization
- Minimum variance
- CuReD
- Projection



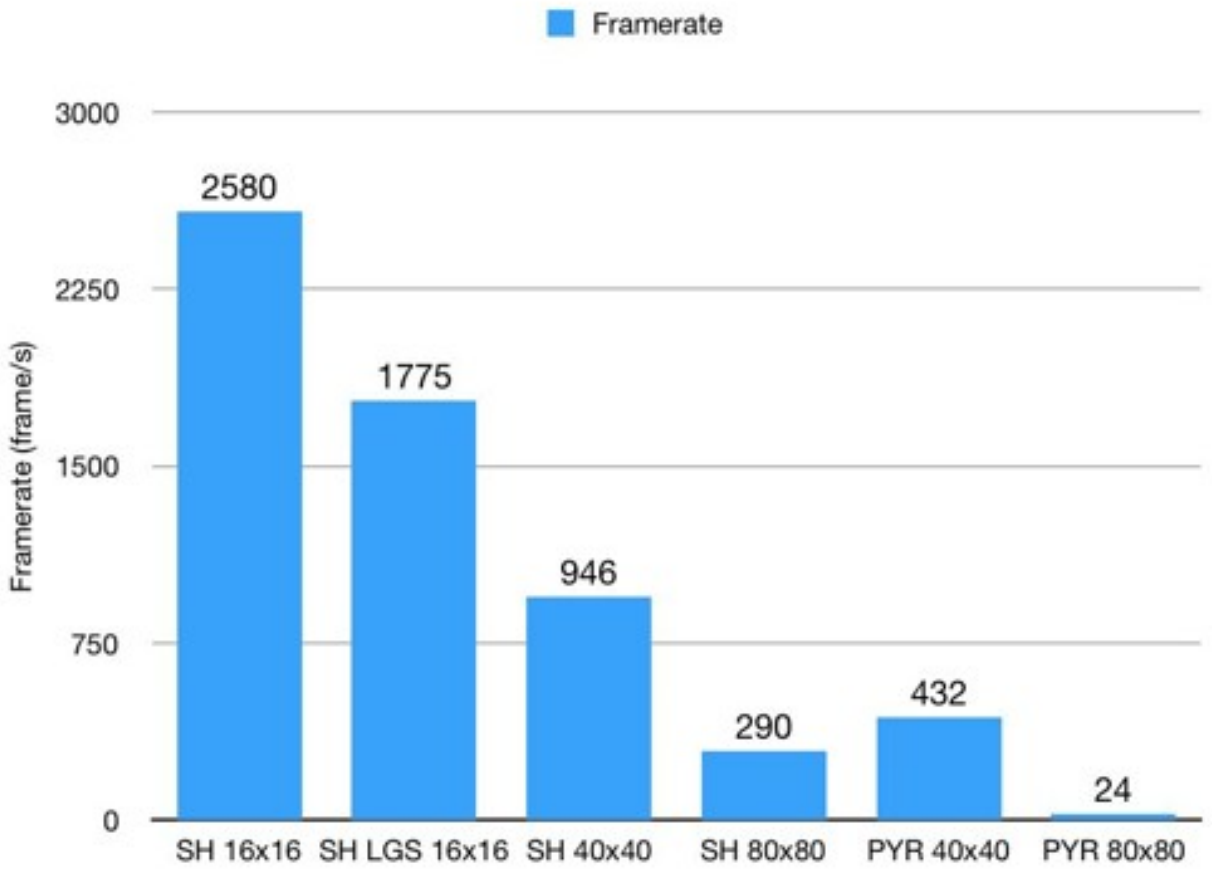


E-ELT:

- Hexagonal pupil
- Spiders
- Phase aberration
- M4 influence functions

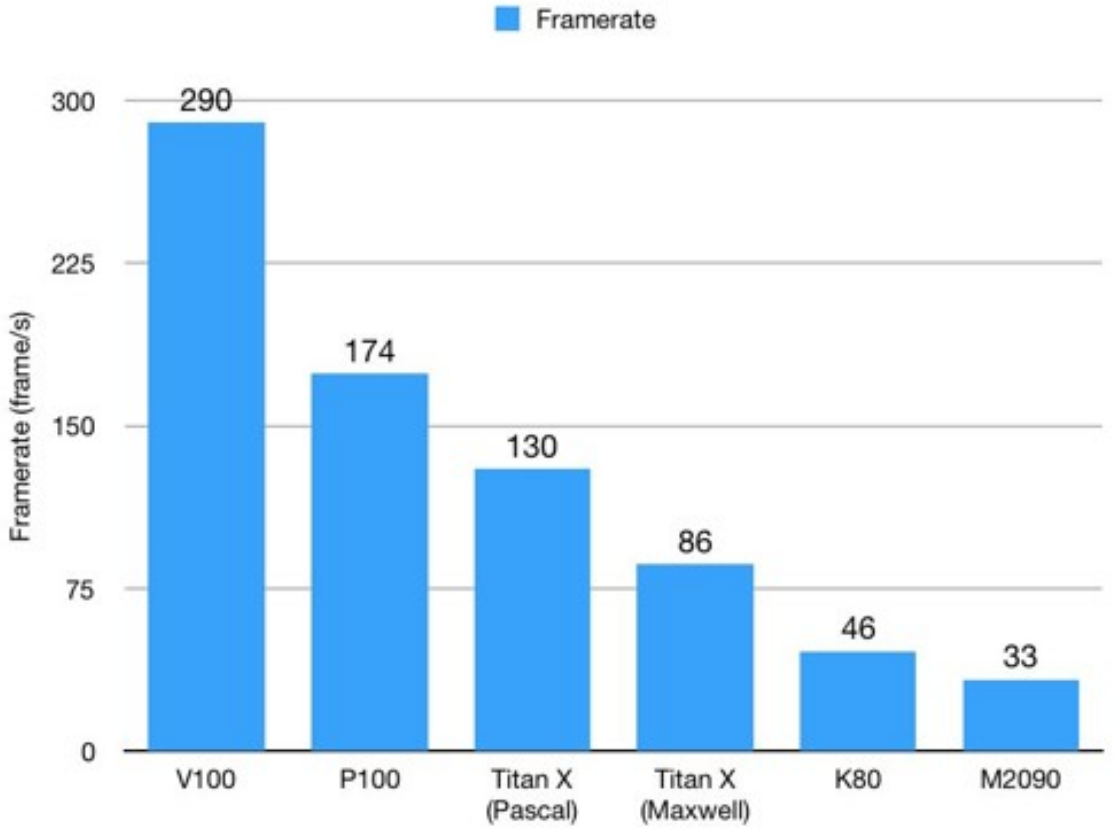
Real-time simulator

- Time to solution on NVIDIA V100 for various system scales



Real-time simulator

- Time to solution (80x80 SH) for various GPU generations (memory bound)
- Using COMPASS for E2E should provide a scalable solution over the long term



Contribution to WP 6: simulator

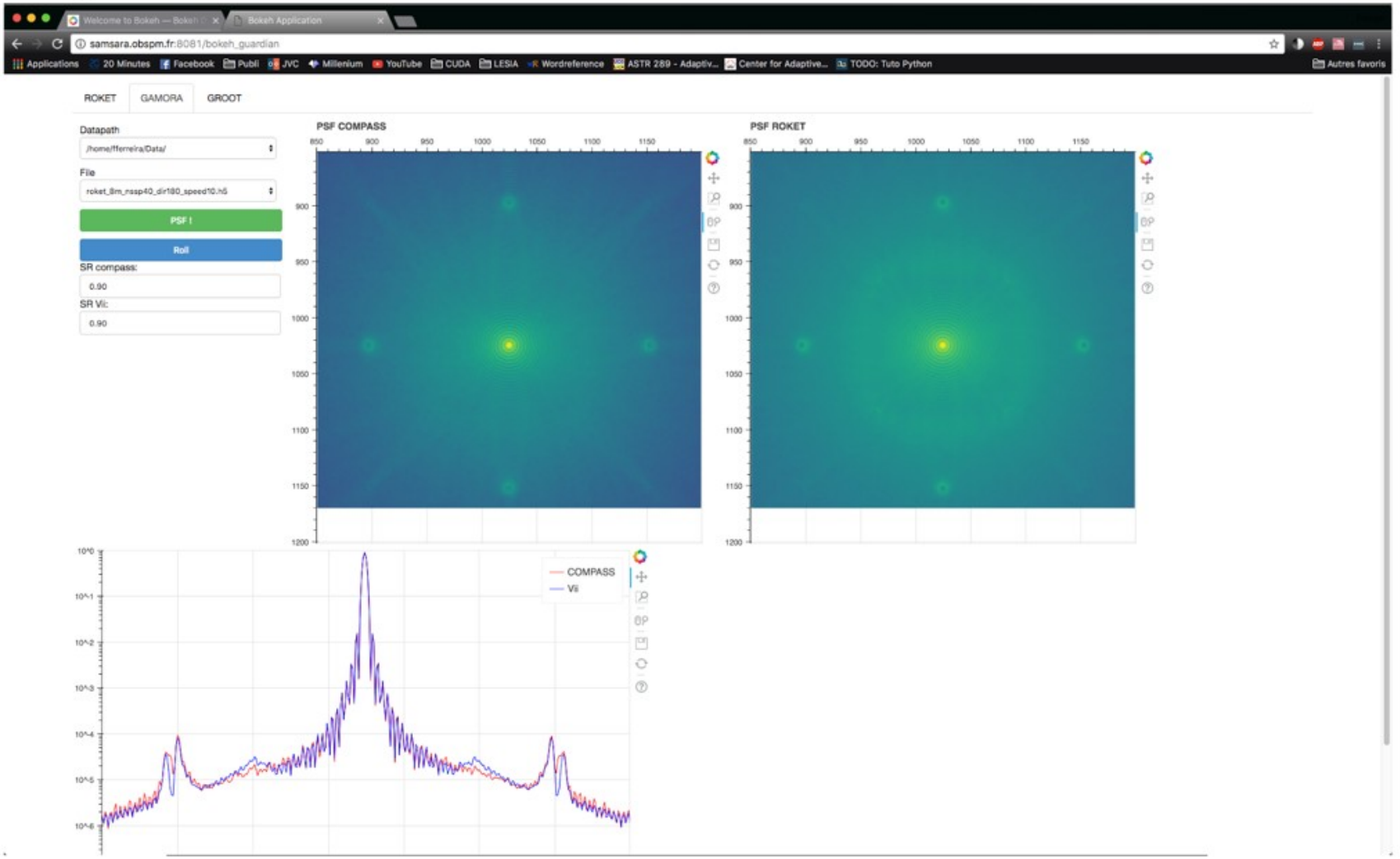
Current development on interface with real-time pipeline

- Based on previous experience with instruments control SW
- Using DDS as middleware
- Sustained simulation framerate is 90% on standalone simulation speed
- In collaboration with UoD

Implementing key components in the simulation

- Accurate error budget for the AO loop : prototype output validation (PhD thesis)
- Critical E-ELT features : deformable mirror and segmented pupil (SW engineer + instrument scientist)

Contribution to WP 6: simulator



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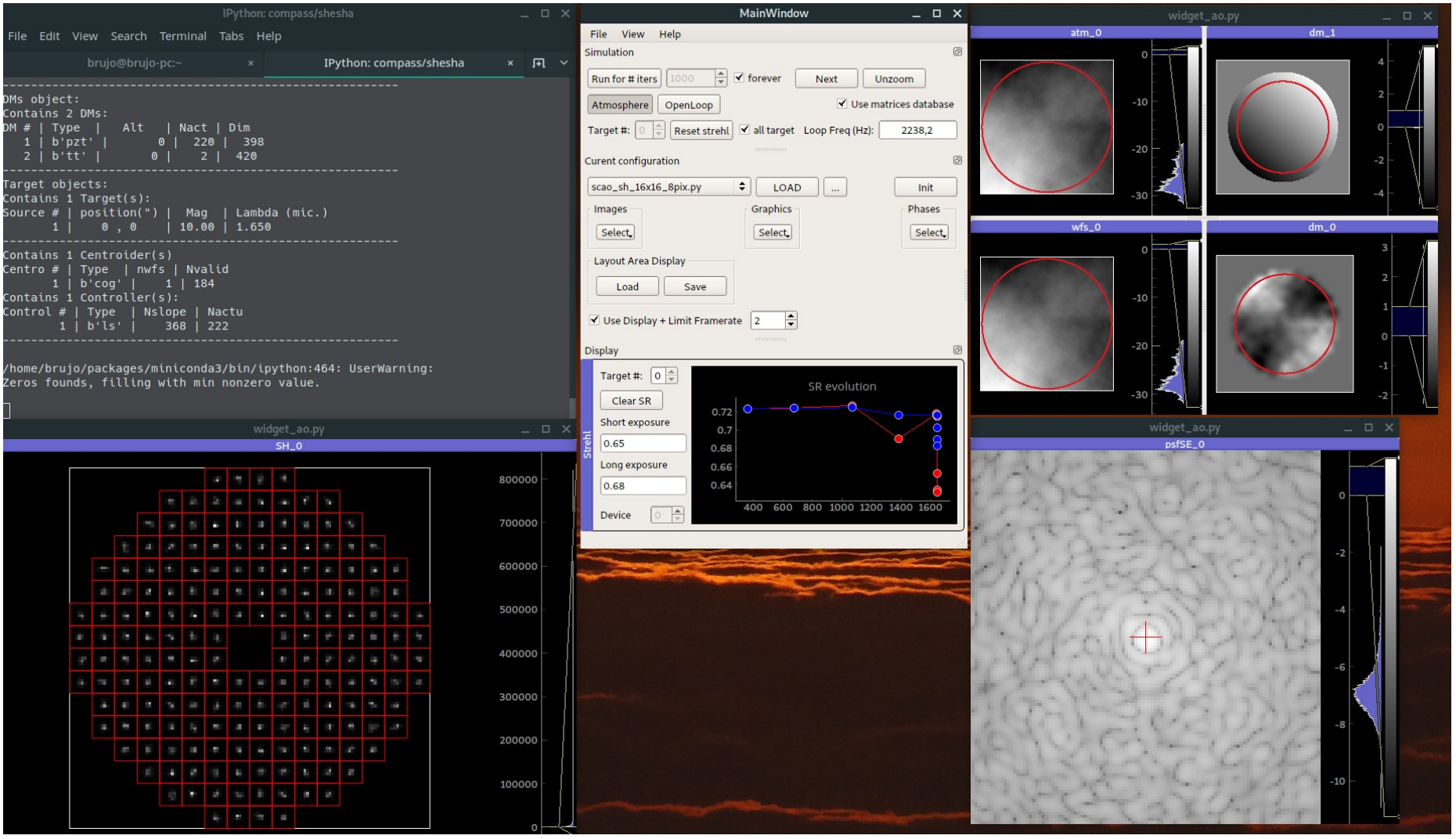
Contribution to WP 6: simulator



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WP6: deliverables

Task 6.1 (UoD):

- D6.1: Simulator interface definition document (UoD – M12)
- D2.2: Simulator HW final design report (UoD – M24)

Task 6.2 (OdP):

- D6.4: Simulator SW final design report (OdP – M24 – submitted)

Task 6.3 (UoD):

- D6.3: Simulator performance report (UoD – M24)